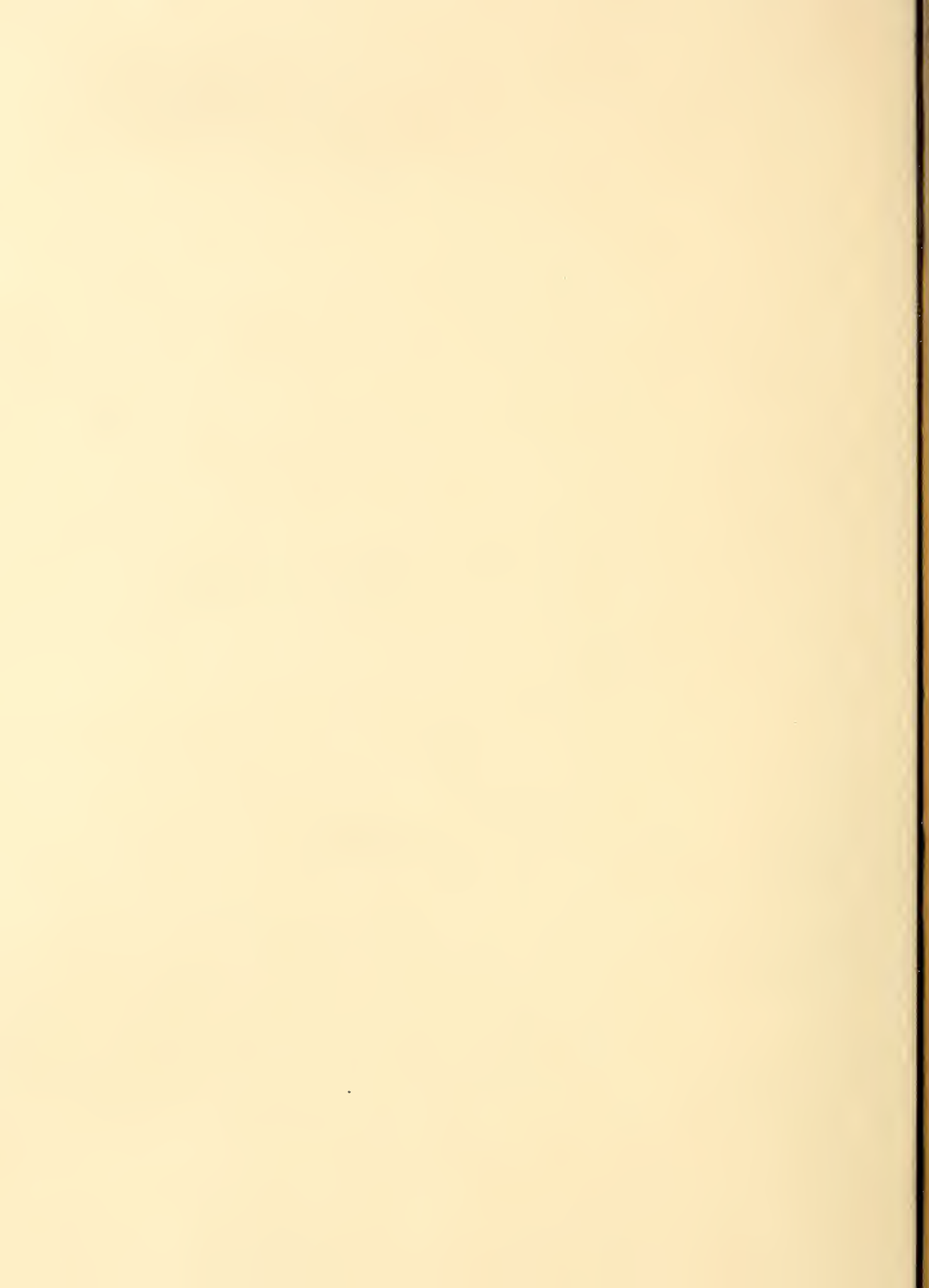


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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**

JULY 1947

EROSION CONTROL PRACTICES DIVISION

Effects of Irrigation Practices on Soil Structure - D. S. Hubbell, State College, New Mexico.-"Field studies on the effects of irrigation practices on soil structure have thus far shown no relationship between quantity of water applied and percentage of aggregation. The only interesting development in the study is that cotton plants, which thus far received only 12 inches of water, are fully as vigorous as those which have received normal applications of 24 inches of water. Time of application has not varied among the treatments. The quantity of water with each irrigation amounted to 3 inches for the low-moisture plots and 6 inches for the high moisture plots.

"Laboratory studies still persist in their trend to show that lack of air and saturation in water does not materially decrease aggregate formation, even though the microbial population is greatly reduced. Compaction of the soil seems to be the factor most detrimental to aggregate formation. These trends are far more apparent in heavy soils than in light-textured soils."

Raindrop Erosion Studies - H. O. Hill, Temple, Texas.-"Mr. L. Sreenivas, a student from India, taking graduate work at the A & M College of Texas, is doing his thesis work at this station. The subject of his thesis is 'The Effect of Different Percentage of Cover on Raindrop Splash.' Using a rain applicator similar to Ellison's design, Mr. Sreenivas obtained some very interesting data using strips of burlap to obtain different degrees of cover. From instillations to catch natural rainfall splash, a close agreement was found between splashed material and soil erosion loss by erosion under similar cover."

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**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Effects of Past Erosion on Crop Yield - O. R. Neal, New Brunswick, New Jersey.-"In continuation of our studies on crop yields from eroded and uneroded areas, yields of wheat were measured on triplicate areas of eroded and uneroded soil on two different farms in Monmouth County. The average yield on one farm was 15 bushels per acre from eroded soil and 38 bushels from the relatively uneroded soil. Corresponding figures from the second farm were 17 bushels and 47 bushels.

"Variations in potato yield during past years on different depths of surface soil have shown an average yield reduction of about 25 percent as a result of erosion. With other crops the differences have been much greater. Yields of corn, soybeans, alfalfa, and several small grain crops are commonly two to three times as great from uneroded areas as from eroded areas within the same field. These latter crops are ordinarily less heavily fertilized than are potatoes. Under such conditions the growth and yield of the crop is more dependent on the inherent productive capacity of the soil. Such capacity appears to be markedly reduced as a result of continued erosion."

Heavy Erosion Losses in May and June - Dwight D. Smith, Columbia, Missouri.-"Calculation of erosion losses for cropland during the months of May and June for the 44 counties north of the Missouri River indicated an average loss of 28 tons per acre on 5,500,000 acres. The severe losses occurred during June when the rainfall averaged 2.6 times normal. Based on measured plot rainfall-soil loss relationships, this would have produced a soil loss 4.1 times normal. The maximum losses were within the Marshall-Menfro-Shelby soil resource area E4a3. It was 39 tons per acre on 1,065,000 acres. Rainfall in the Grundy-Shelby-Lindley soil resource area E7a was 3.3 times normal, the maximum for the 6 areas of the north half of the state. This produced a soil loss of about 31 tons per acre, or 5.1 times normal. Rainfall during May averaged only a little above normal, resulting in an estimated soil loss only about 15% above normal. These figures were based upon average rainfall-soil loss relationship curves for May and June. These losses would have been increased about 35% if the relationship curve for the maximum measured losses had been used."

Permeability of Subsoil in Relation to Infiltration and Runoff - T. C. Peele, Clemson, S. C.-"Data from some of the runoff plots at Clemson indicate that subsoil permeability is an important factor in determining infiltration and runoff during the winter and spring months.

"Two plots on Cecil sandy loam, under excellent cover consisting of corn stalk residue and a heavy growth of vetch and rye, gave widely different runoff values from large storms in the winter and spring. During 4.72 inches rainfall January 16-20, 1947, plot 5R had 50.1 percent runoff while plot 7R with the same treatment had only 1.6 percent runoff. Both plots had excellent cover so the high runoff from plot 5R cannot be attributed to surface sealing but apparently was due to the internal permeability of the soil.

"Percolation rates measured through undisturbed cores of the subsoils showed a rate of 0.32 inches per hour for plot 5R, and a rate of 1.80 inches per hour for plot 7R at 20 degrees centigrade."

"During the summer months subsoils of both plots became dried out to considerable depths and they can absorb water more rapidly. The runoff from both plots correlates closely with cover conditions during the summer. Apparently surface conditions are of primary importance in determining the amounts of infiltration and runoff during this time of the year.

"The average infiltration rates of these plots for several large summer and winter storms are shown in the following table together with percolation rates of the subsoils. The infiltration rates were determined by plotting the rainfall for each 5 minute period and drawing a line at the intensity value where the quantity of rainfall exceeding this intensity value is equal to the quantity of runoff from the plot.

"The percolation rates of the soil cores were in the same order as the infiltration rates during the winter storms. The percolations rates corrected to 5° centigrade were about twice as high as the field infiltration rates."

Relation of soil permeability to infiltration rates of mulch plots on Cecil sandy loam.

. Date	Crop	Rainfall	: Average infiltration rate	
			: Plot 5R	: Plot 7R
		Inches	in./hr.	in./hr.
3-19-44	Vetch & rye	5.08	0.16	0.82
3-27-44	Vetch & rye	3.48	0.08	0.71
1-16-47	Vetch & rye	4.72	0.08	0.66
Average			0.10	0.68
7-15-46	Corn	1.96	6.30	6.49
8-21-46	Corn	4.46	1.56	2.76
8-17-44	Corn	1.37	4.80	5.66
7-19-45	Corn	3.10	3.48	4.06
Average			4.03	4.74
Percolation rate of subsoil			0.32	1.80 - 20° C.
Percolation rate of subsoil			0.21	1.19 - 5° C.

Moisture Tension and Pore Space Relationships in Soil Profiles -
 Richard M. Smith, Morgantown, West Virginia.-"We have been studying the moisture tension and pore space relations of several soil profiles to determine more details about the true tension and available water supplies of various soils. This work has now been carried far enough in the field and laboratory that we are writing it up for a paper to be presented at the fall meetings of the Soil Science Society.

"The main conclusion from this study seems to be that field capacity is normally represented by a relatively low moisture tension. The relationship between field capacity and the moisture equivalent is primarily a matter of the pore space pattern of the particular soil and the degree of saturation obtained. It is only by lack of saturation that field capacity can be equal to or less than the moisture equivalent. These results seem to have considerable importance in estimating available water supplies in our various soil profiles."

Moisture Content of Materials Used in Pond Dams in Relation To Permeability of the Packing - "On a recent trip with Mr. Patton, State Soil Scientist and Dr. Galpin, Hydrologist of the Experiment Station, we made interesting observations of pond dams being constructed in the Southern District.

"The purpose of the trip was to help to determine the most suitable materials to use in that area and to avoid dam failures wherever possible. Several samples that we collected for laboratory tests proved to be especially interesting from the standpoint of moisture content of packing. Using a standard packing procedure, we found that common materials gave a permeability rate of more than 0.1 inch per hour when packed dry, and percolation rates of less than .001 when packed at just the right moisture content. These results encourage a closer check on the moisture content in field construction, and if further difficulties are encountered, it is planned to set up a procedure for checking in the field to be sure that the moisture content and packing are kept within safe limits."

Progress in Developing Erosion-Control Uses of Class IV Land - F. L. Duley, Lincoln, Nebraska. - "Considerable brome grass seed has been harvested with the combine. The seed yield was good and quality excellent. Our results with brome grass on Class IV land have been outstanding. It is on this type of land that the Operations Division has been wanting more information for use in this Region. We now have several years' results that are showing how we can protect this land from erosion and at the same time provide sufficient available nitrogen for good crop yields. At Hastings, where we grow sweetclover on the land as preparation for brome grass, excellent growth was obtained. By this method the soil is protected from erosion during the 2 years while the land is in sweetclover. Then the sweetclover is mowed before it produces seed, or when only very little seed has set. This residue is allowed to lie on the ground. When thoroughly dry it is broken with a treader and the soil subtilled. The grass is then seeded in August. Excellent stands and luxuriant growth of brome, crested, and intermediate wheat grass have been obtained. Seed yields have been high. Sweetclover is also being used in a stubble mulch system on Class IV land where small grain or row crops follow the legume. When used in this way, the sweetclover protects the soil from erosion while the crop is growing and continues to do this by means of the residue during the growth of the following crop. In addition to this, it supplies an abundance of nitrogen for use by the grain crop. The grain crop residues are then used until sweetclover is again grown on the land.

"The value of several other legumes in connection with stubble mulch is also being tested. In wheat this year we had volunteer lespedeza (19604) and partridge peas (Chamaecrista fasciculata) in excellent stands. Where these volunteered in oats in 1946 there is greatly improved corn this year. The advantage in using the stubble mulch system in connection with these legumes is that the seed is not buried as in plowing and better stands of volunteer legumes are obtained, and the soil can be continuously protected against excessive erosion."

Corn Tillage Studies - Ralph A. Cline, Brookings, South Dakota.-

"Even though the corn is about 10 days late it has "caught up" considerably in the last two weeks. Corn that was only 10 inches high on July 1 is now 40 inches high or higher. Color is universally good on all plots irrespective of previous tillage or residue treatment. The crop was laid by after the fourth cultivation with the plots relatively free of weeds. To date, just a minimum amount of hand hoeing has been required to keep weeds in check. Changing from surface to furrow method of planting may have helped considerably in getting such good control. The most outstanding corn plots are those following four years of grass (broken out in the fall of 1945). The corn on these plots have had the most vigor, made more rapid growth and were the first to tassel out. Corn on the residue treated plots, when rated on amount of growth, uniformity of stand and stand would rank in the following order: 6 inches stubble plus manure; combine stubble; 12 inch stubble; 6 inch stubble, and, mowed stubble. On July 31 the corn on subsurface tilled and moldboard plowing far excell the corn on oneway disking. Some damage has been done to the corn by the corn heart borer, particularly to rows adjacent to grass."

Grasshopper Damage - G. M. Browning, Ames, Iowa.-"By the last of the month the grasshopper population in the pastures was very high and extensive damage has been caused by their removing the leaves from the alfalfa plants. Poison bran is being used in an effort to control grasshoppers. Considerable damage has been done to certain of the corn plots in the rotation experiment and to the meadow seedings on the rotation plots. These plots have been sprayed with chloridane to control grasshoppers."

Nitrogen Deficiency Symptoms in Corn as Related to Rotation Plan -

"Differences in growth of corn on the rotation plots, depending upon the intensity of the rotation, is even more outstanding this year than in previous years. Second-year corn in intensive rotations including two years of corn, using a minimum of meadow in the rotation, are showing marked nitrogen deficiency symptoms and the growth is only about half that on the first-year corn following meadow in the rotation. There is also a large difference in growth in the corn on the control plots. Continuous corn averages about 2-1/2 to 3 feet in height while the corn in a corn-oats-meadow rotation ranges from 7 to 8 feet. Differences in color are more pronounced than in previous years with the continuous corn light green in color while rotation corn has a very dark green color. On the plots that were converted from continuous corn to a rotation of corn-oats-meadow in 1943, nitrogen deficiency symptoms are very evident. The growth of corn while considerably greater than on the continuous corn still is much less than corn that has been grown in a corn-oats-meadow rotation since 1931."

Observational Plantings of Caley Peas, Grandiflora Vetch and Bur Clover - E. C. Richardson, Auburn, Alabama.-"Seedings of the above crops were made, following corn, in September, 1944. Good stands were obtained. In the spring of 1945 these were allowed to grow to maturity, each producing a satisfactory seed crop. When mature, the vegetative growth and seed were turned and followed with a summer crop. Since 1945, the areas on which these legumes were grown were prepared for corn early enough to prevent the production of any seed; therefore, stands obtained in the fall of 1945 and 1946 were from seed produced in the spring of 1945. The data are shown in the following table:

Caley Peas, Grandiflora Vetch and Bur Clover Volunteers for More than 1 Year

Year	Caley Peas		Grandiflora Vetch		Bur Clover		Turning date of winter legumes
	Yield of:		Yield of:		Yield of:		
	Green wt.:	crops	Green wt.:	crops	Green wt.:	crops	
	Lbs./A.	Bushels:	Lbs./A.	Bushels:	Lbs./A.	Bushels:	
	per acre:		per acre:		per acre:		
1945	Not de- termined	48.2 Grain sorghum	Not de- termined	47.7 Grain sorghum	Not de- termined	40 Grain sorghum	June 15
1946	16,000	64-Corn	21,000	60-Corn	6,000	40 Corn	April 4
1947	19,520	- Corn	15,260	Corn	3,000	--	April 22

Winter legumes were planted in 1944 and matured seed in 1945. All of the seed were turned into the soil when it was prepared for grain sorghum.

No winter legume seed have been produced since 1945. Growth of winter legumes turned in 1946 and 1947 were from seed produced in 1945, that remained in the soil.

"Two excellent volunteer stands of Caley peas and grandiflora vetch were obtained after turning a heavy seed crop in 1945. The stand of Caley peas that came up in 1946 was much thicker than that obtained in 1945. The stand of vetch that came up in 1945 was much thicker than that obtained in 1946; however, the stand obtained in 1946 was fully adequate.

"Bur clover on this area has not produced a satisfactory volunteer stand at any time. Each spring soon after turning for corn, bur clover began germinating and continued to germinate throughout the summer. Plants that came up during this period were killed by cultivation or drought. Probably most of the clover seed near enough the surface came up during the summer, leaving only a small amount of seed in position to germinate when conditions in the fall were right for development of seedlings."

Long-Time Benefits of Soil Conservation (Also published in Illinois Farm Economics) - E. L. Sauer, Urbana, Illinois.-"Conservation increases production and income, prevents soil erosion and the loss of capital resources, and leaves the farm more productive. A long-time study of the costs and benefits of soil and water conservation in three selected areas of Illinois shows that yields and incomes are increasing more on farms

with high conservation scores than on farms with low scores. (Table 1). Farm account records were obtained on sample farms with similar land use capabilities but with differences in the extent of use of soil and water conservation practices.

Table 1.--Yields and Income on Identical Farms for Two Periods, by Areas, Farms with High and Low Conservation Scores a/...

Area and years	Crop yields ^{b/}		Net income per acre	
	Farms with high scores	Farms with low scores	Farms with high scores	Farms with low scores
McLean county				
1935	97	103	\$ 5.78	\$ 6.54
1945	106	94	27.51	22.64
Madison-St. Clair counties				
1939	100	100	9.87	9.84
1945	107	94	14.60	6.29
Stephenson, Jo Daviess, and Winnebago counties				
1940	98	102	12.46	12.91
1945	105	95	21.23	13.86

a/ Conservation scores as computed for the year 1945.

b/ Average yields of all crops for all farms in each area equals 100.

Contour farming is profitable - "By preventing runoff of most of the rainfall, contouring conserves moisture needed for plant growth and prevents soil losses. When compared to farming up and down the slope on the same farms, contouring has increased grain yields from 12 to 17 percent."

Conservation needs and costs - "Conservation needs vary by areas but in general the cost of establishing a complete conservation plan is from \$15 to \$25 per acre. Greater needs for limestone, phosphate, and other fertilizers makes the costs higher in poorer land areas. Needed drainage makes the costs relatively high in some of the better land areas of central Illinois."

Summary - "The adoption of a complete conservation plan usually reduces for one or more years the net income below what it would be from farming without conservation. Studies in different areas of the state show, however, that money spent on conservation is a sound investment resulting in increased net income in from two to six years, depending on the extent of the farm's conservation needs. Returns from such investments afford a safe basis for credit for establishing the conservation program. Although the net income may be temporarily reduced, the productive value of the land increases immediately, protecting the financial position of the landowner until the long-time benefits of conservation accrue."

Effect of Fertilizer on Growth of Two Fall-Planted Sweet Clovers
Growing in Oats on Austin Clay Soil. Sampled June 10, 1947 - J. R.
Johnston, Tyler, Texas.-

Sweet Clover Variety	Fertilizer Treatment	Dry Matter Produced*		
		Tops	Roots	Total
Hubam	None	387	78	465
Hubam	40 lb. P_2O_5/A	2059	278	2337
Madrid	None	727	200	927
Madrid	40 lb. P_2O_5/A	5482	1026	6508

* Data are average from two plots - 1 sample taken from each plot.

Western Wheatgrass Responds to Nitrate Fertilizer - C. J.
Whitfield, Amarillo, Texas.-"Three different rates of 20 percent ammonium sulphate were applied to an established stand of western wheatgrass. The rates of application were 100 pounds per acre, 200 pounds per acre, and 300 pounds per acre. The percentage increase from the different rates of application were 15, 31 and 54 percent, respectively. A good seed crop was produced on the fertilized areas. The total rainfall from the date the fertilizer was applied until hay yields were taken was 8.54 inches."

Wheat Yields Increased by Cropping System - "The cumulative effect of a 3-year cropping system of wheat, grain sorghum, and fallow increased the wheat yield during the 1947 crop season 24 percent. The average yield of wheat in the 3-year system was 34.6 bushels per acre, in comparison to only 27.8 bushels per acre on continuous wheat, a difference of 6.8 bushels per acre, in favor of the 3-year cropping system."

Crested Wheatgrass Produces Good Seed Crop - "A total of 13,345 pounds of crested wheat seed was harvested from a 44-acre pasture which had been grazed since the first of April. The average seed yield per acre was 303 pounds. An average of 436 pounds of seed per acre was harvested from adjoining areas which were not grazed during the year. Ungrazed western wheatgrass produced approximately 200 pounds of seed to the acre."

Contouring Versus Up-And-Down Slope Planting of Corn and Soybeans -
C. A. Van Doren, Urbana, Illinois.-"Soil losses during May were slightly greater on those plots which were in soybeans in 1946 than from those in corn. Total soil losses, however, for the three months period - May through July - were not significantly greater from the plots in soybeans in 1946. No erosive storms occurred during the seedling stage to permit an adequate check of the effectiveness of corn compared to soybeans when planted on the contour. In 1946 the soybeans were very much more effective during their early growth in checking soil losses than were the corn plants. During the three months period in 1947 the soil losses from contoured corn were 58 percent of the losses from up-and-down plot. Losses from the contoured plot in soybeans were 37 percent of the losses from the plot planted up-and-down the slope."

Date 1947	Rainfall Inches	Soil Losses - Pounds per Acre			
		Previous crop - corn planted to soybeans		Previous crop - soybeans planted to corn	
		Contour Plot 1	Up & Down Plot 2	Contour Plot 4	Up & Down Plot 3
May 15	1.47	1544	2405	2753	2370
May 17	0.35	249	276	362	1537
May 19	0.30	221	269	365	347
May 20-21	0.74	18	24	26	44
Sub-total (May)		2032	2974	3506	4298
June 7	0.54	0	955	0	243
June 7	0.50	33	596	0	451
June 10-11	0.45	0	0	0	22
June 17-18	0.41	0	0	0	12
June 17-19	1.88	0	37	0	50
June 23-24	1.27	0	120	0	15
July 1	0.81	673	2623	472	1723
Total (May-July)		2738	7305	3978	6814

Renovation of Bluegrass Pastures - Orville E. Hays, LaCrosse, Wisconsin. - "Bluegrass pastures which have the habit of becoming unproductive in late summer can be made quite productive if seeded to alfalfa and brome grass. Yield data show that the carrying capacity of a good renovated pasture is more than double that of a fertilized bluegrass pasture.

"Data from small plots, 72 feet long by 30 feet wide, show that if the bluegrass is worked with a field cultivator most of the bluegrass residue is left on the surface of the ground thus producing an effective mulch which protects the soil from the rains thereby greatly reducing soil losses. During the fall of 1946, two pasture plots were worked with the field cultivator and two were plowed. The plots worked with the field cultivator were cultivated four times during the fall and once in the spring. Soil losses thus far this year were not excessive from either treatment. They do, however, show interesting trends.

"Runoff and soil loss data from January 1 to July 14, 1947 are shown in the following table.

Plot Number	Treatment	Runoff (Inches)	Soil Loss (Tons per acre)
3	Plowed	1.42	1.14
6	Plowed	1.64	1.55
4	Field cultivator	0.87	0.07
8	Field cultivator	1.79	0.09

"The runoff from Plot number 8 was influenced by snow drifts. These data show that even a small amount of organic residue on the surface of the soil will have a tremendous effect on runoff and soil loss."

Beef Gains Low in July - C. J. Whitfield, Amarillo, Texas.-

"Gains during the month were relatively low. Steers on sudan during the last half of July did better than other lots. The best grass pasture was reseeded I-2(E).

"Probably the principal factor accounting for the low gains was the hot dry weather condition that existed during most of the month. Little precipitation, high temperatures, and low soil moisture left the grass in a dry, brownish state. Gains were as follows:

Lot No.	Ave. Wt. 8/1/47	Pasture Grazed	Ave. Daily Gain
1	818.5	Seeded Mixture, 7/1-16 Sudan, 7/16-8/1	0.23 1.44 1.67
2	784.5	Seeded western wheat, 7/1-16 Sudan, 7/16-8/1	0.60 1.80 2.40
3	829.5	Seeded mixture	1.16
4	827.0	Native and seeded	0.54
10	807.0	Native and seeded	0.65

Weeds in Relation to Seedbed Preparation for Spring Wheat - Fargo, North Dakota.-"Weed counts made during the latter part of July showed some variation in the amount of weed growth between the method of spring tillage used in seedbed preparation under continuous wheat at Edgeley, as indicated by the following table.

Weed growth in pounds an acre, oven-dry basis, as affected by the method of tillage used in seedbed preparation for continuous wheat, Edgeley, 7/24/47.

Tillage Method	Pounds of weeds an acre			
	Pigeongrass	Wild buckwheat	Russian thistle	Misc. Total
2 Ton straw, stubble mulch	81.7	19.8	45.9	47.5 194.9
Moldboard plow	58.2	38.9	220.5	14.4 332.0
Stubble mulch	209.7	41.7	114.2	108.8 474.4
Disk	311.1	37.9	120.1	45.4 514.5
Field cultivator	242.8	43.6	293.4	17.1 601.9
Burn stubble, no tillage	322.8	6.9	191.5	310.0 831.2

"This season stubble mulch tillage of stubble land to which straw was returned at the rate of 2 tons an acre showed the least total amount of weed growth. The Russian thistle growth on plowing was largely responsible for the greater total weed growth here than on the stubble mulch plots. Stubble mulch tillage without added straw produced considerably greater quantities of pigeongrass and miscellaneous weeds than did either stubble mulch tillage without added straw or plowing. Pigeongrass and Russian thistle contributed the greater portion of weed growth under tillage with the disk or the field cultivator.

"The greatest weed growth occurred on the burned plots where weeds, such as dandelion, goatsbeard and wild barley, not generally found on tilled plots occurred to a considerably greater extent."

Soil Organic Matter Build-Up - B. H. Hendrickson, Watkinsville, Georgia.-"Further analysis of replicate soil analyses of rotation plots, on this Station, made at Dr. T. C. Peele's laboratory at Clemson, S. C., indicate an interesting trend with reference to organic matter "build-up".

"With the 3-year rotation of Oats-lespedeza (for grain and seed), volunteer lespedeza (for seed), and cotton, the percentage of "build-up" of soil organic matter during 1 cycle of the rotation varied depending upon whether the starting level was relatively low, medium or high, and upon the crop yields.

"For the low group, beginning with but .75 to 1.00 percent organic matter, with cotton and oat yields not far from State's average, the degree of "build-up" was 21.6 percent (percentage increase of original percent of organic matter). The intermediate group showed 16.7 percent "build-up". The high group, at over 1.25 percent organic matter starting levels, averaged 9.7 percent "build-up", but for this group the cotton yields were near one bale per acre and oat yields around 65 bushels per acre.

"Conservationists in the South are very much interested in raising and maintaining higher productive levels of eroded croplands. The indications are that we have not reached the 'peak' of soil organic matter 'build-up' with this rotation. It has proven to be a valuable and practical rotation to use on the average farm in the Southern Piedmont, especially during the early stages of soil conditioning."

Earthworm Populations - Henry Hopp, Beltsville, Maryland.-"Our studies of earthworm populations under various types of land use are indicating that clean cultivation reduces not only the immediate population of this soil-forming group of organisms, but also holds them in a reduced state for approximately a year thereafter. This is illustrated in the following table, which distinguishes immature or 'baby' worms from mature worms, under sod and row crops.

Season	:Earthworms (thousands / acre)			
	: Sod		: Corn	
	: Young	: Mature	: Young	: Mature
	:	:	:	:
Winter	: 212	: 155	: 45	: 40
	:	:	:	:
Spring	: 220	: 370*	: 90	: 65
	:	:	:	:
Summer	: 250	: 220	: 50	: 85
	:	:	:	:
Late summer	: 295*	: 10	: 125	: 30
	:	:	:	:
Fall	: 150	: 165	: 145*	: 120*
	:	:	:	:

* Peak population in each column.

"It is seen that under sod, the mature worms are fewest in the late summer when young worms are at their peak. These young worms then mature, so that relatively large numbers of mature worms occur over the winter, spring and summer. Hence, under sod, these soil-building organisms could be effective over a large part of the year. Under row-cropping, the normal cycle was drastically changed. The worms which normally would have matured during the winter were largely wiped out by the first heavy freezes. In the spring, there were few mature worms present to rebuild soil structure following the previous year's cultivation. Only late in the fall did they attain relatively large numbers. Since this peak came just prior to the freeze, a large population was maintained for a relatively few days only.

"These data point out the importance of understanding the effects of cultivation not only on the immediate structure of the soil, but also on the soil-structural factors that we depend upon for future soil-building."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - W. D. Ellison, Washington, D. C.-There appeared in "Agricultural Engineering" for July a paper entitled "Soil Erosion Studies - Part IV (Soil Erosion Loss and Some Effects of Soil Erosion."

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"The storm of July 18 of 1.35 inches was the only one in the month in which surface runoff and soil loss occurred. Runoff from corn watersheds is as follows:

	<u>Inches</u>
Poor practices (straight row)	0.03
Conservation practices (contour rows)	.006
Conservation practices (mulch)	Trace

"Because of the low amount of rainfall and the large amount of water pumped out of the ground by crops, seep flow on the 8-acre watersheds has stopped. Surface flow from the 8-acre corn-meadow strip watershed for the July 18 storm totaled 0.011 inch.

"Dr. Miles W. Cubbin and Leonard B. Corwin of the Flood Control office, Region I, visited this station July 21 - 25 to obtain basic hydrologic data to assist them in their flood-control survey of the Youghiogheny River. Much of the information desired fits in with our plan of analysis for watershed data. Some values and curves had already been derived and others had to be computed. Some of the more important items required for this flood survey were:

1. Rates of infiltration into the soil surface.
Rates of water transmitted through the topsoil.
Rates of water percolating into the subsoil.
(Values for forested, pasture, and cultivated land; for a well-drained and a slowly permeable profile; and for storms having different antecedent soil moisture.)
2. Complete infiltration curves for different land use and soils, related to the range of soil moisture observed.
3. Values of moisture in the topsoil required for runoff occurrence.
4. Time relationships for soil moisture to deplete from maximum observed to field capacity.
5. Evapo-transpiration rates from lysimeters and soil-moisture observations and evacuation of soil pores.
6. Comparison of purely surface runoff from small watersheds with combined surface and subsurface flow from larger watersheds - timing, rates, and amounts.
7. Rainfall interception storage for different crops.

"Messrs. Cubbin and Corwin expressed the urgency of having a substantial basis for the flood control. For 2 weeks after their visit, therefore, Messrs. Schiff, Dreibélbis, and others devoted most of their time to analyses of data to yield working tools as outlined above."

Hydrologic Studies - R. B. Hickok, LaFayette, Ind.-This report will cover May through July. "May and June rainfall totals were near normal for the vicinity. However, the distribution of May rainfall was unusual, in that rain was recorded 15 days out of the month. This seriously hampered spring field work and resulted in generally very late seeding of both corn and beans. July rainfall was substantially below normal.

"About 3 inches of rain fell at the Purdue Dairy Experiment Farm on June 6-8, following a series of smaller storms that had saturated the litter and soil in the wooded watersheds. Under those conditions the unpastured woods yielded over 89 percent in runoff and the pastured woods about half that amount. The bluegrass pastures lost about 60 percent of the rainfall from one that had moderately heavy cover and about 80 percent from one that had heavy growth that had not been pastured. This bears out the previous findings that the effect of antecedent rainfall on subsequent runoff has been directly related to the density of cover. Thus, in extended rainy periods, heavy woods or grass covers may increase floods.

"The June 6-7 rainfall on the Throckmorton Farm averaged about 1.75 inches. On the rotation-crop watersheds, the total runoff losses were as follows:

Table 1.--Total runoff from rotation crop watersheds,
Purdue-Throckmorton Farm, LaFayette, Ind., June 6-
7, 1947

Crop	Treatment	Wsd. No.	Total Runoff
			Inches
Corn	Conservation	2	None
		11	0.31
	Prevailing	4	.21
		12	.71
Soy Beans	Conservation	7	.27
		6	.24
	Prevailing	8	.56
		5	.34
Wheat	Conservation	18	.31
		14	.34
	Prevailing	10	.98
		15	.28

"It appears that there was no significant difference in total water losses from corn, wheat, and beans, but substantially lower losses from conservation-treated watersheds in each crop than from those under 'prevailing' treatment."

Runoff Studies - T. W. Edminister, Blacksburg, Va.--"Mr. H. N. Holtan and the Project Supervisor visited a number of farm-pond problems in the areas around Winchester, Harrisonburg, Staunton, Lexington, and Charlottesville. Dr. H. W. Jackson, Experiment Station Project Leader on Fish Cultural Problems, accompanied the above personnel on one field trip in order to observe and advise on the possibility of biotic activity causing development of a number of small holes on a portion of a pond bottom that had not been submerged. Dr. Jackson stated that these holes could in all probability been caused by an emergence of 17-year locusts. The fact that water had not at any time covered the entire pond area made it possible for these locust to complete their life cycle. Observation of the surface conditions surrounding the holes indicate that large quantities of surface runoff have gone into the holes and been carried away. It is probable that the holes eventually empty into natural drainageways and solution channels in the rock crevices beneath the soil mantle. It is improbable that further emergence will occur. It is therefore recommended that the existing passageways be thoroughly broken up by scarifying and recompaction of the pond bottom in order to prevent future seepage losses through these channels.

"The following is a quotation from Mr. Holtan's report to the Project Supervisor outlining the preliminary results from the initial farm-pond survey:

"On these field trips it is judged that less than one-half of the ponds which had high water losses are being seen. Many of the ponds which are leaking badly are not problems because of ample constant supply. Less than one tenth of the total ponds in Districts 13, 8, 2, 11, 4, 5, and 14 have been visited on this survey. Of these, problem ponds run as high as 14 percent of total ponds constructed in the district. The higher percentages occur in the limestone areas:

District	Total Ponds	Problem Ponds Visited	% Total
2	35	2	2.35
4	32	0	0
5	137	2	1.46
8	85	12	14.1
11	94	2	2.13
13	114	1	.88
14	30	2	6.67
Totals	577	21	3.63

"Considering only the 21 ponds visited, leakage was attributed to:

Biotic activity (locusts)	- 1	or 4.7 percent
Through earth fill	- 3	or 14.3 percent
Exposed rock	-11	or 52.4 percent
No key way under fill	- 4	or 19.1 percent
No obvious fault	- 2	or 9.5 percent
Total	21	100.0 percent

"Core wall, soil mantle over the rock, and good keying of fill to residual heavy soil evidently account for 84.8 percent of these failures. In some areas the complete remedy would be a closer adherence to existing construction regulations or instructions. However, in limestone areas, where ponds are frequently most vital to proper land use, proper material for the construction of the fill is hard to find. Usually the soil mantle over rock is so thin that sufficient soil for the fill cannot be scraped off without exposing the rock. The soil mantle thereby becomes of vital concern in the study.

"Logically there are two aspects to the function of a good soil mantle: (1) It must reduce seepage to a quantity less than supply to make the pond serve its immediate purpose, (2) if located over limestone, the mantle must further reduce seepage to an extent where solution channels will not be likely to form in the limestone for a reasonable period of years acceptable as the probable life of the pond. This calls for a higher goal of imperviousness which is definitely beyond the facilities of the field and must be studied in the laboratory."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn. - "Mr. Blaisdell completed a statistical study of the free flow rating for a single test on the box inlet drop spillway model. The study was made in an attempt to determine the best form of the rating equation, all equations being fitted by the method of least squares. The spillway consists of an open topped box having a width W and a length B . Water enters over the two sides and one end, the other end being open to provide an exit. The length of the crest over which water flows is $2B + W = L$. A rating equation which has been frequently used here has the form:

$$Q = C L H^n \text{ - - - - - (1)}$$

where Q is the discharge, C a constant, H the height of the energy line above the crest--that is, the observed head plus the velocity head--and n an exponent that has been found to have a value in the vicinity of 1.6. The theoretical value of n is 1.5.

"The deviations between the observed and computed discharges, using Equation (1), seem to follow a definite pattern rather than a random distribution. It was felt that this might be caused by an error in determining the zero head reading. An equation having the form

$$Q + c L 2g (H - H_Q = 0)^{3/2} \text{ - - - - - (2)}$$

was used in an attempt to evaluate the head at zero discharge $H_Q = 0$. In Equation (2) c is a dimensionless coefficient of discharge. A graphical evaluation of $H_Q = 0$ for several tests indicates that it is not an error in determining the zero of heads but is a correction required for box inlet drop spillways. No relationship between $H_Q = 0$ and any other variable has yet been discovered. The physical significance of $H_Q = 0$ is unknown at present.

"A third equation for the rating curve took the form

$$Q = C_1 g^{1/2} L H^{3/2} + C_2 g^{1/2} H^{5/2} \text{ - - (3)}$$

This is similar to the equation proposed by Francis in 1852 to correct for the effect of contraction at the ends of a weir. The interference to flow at the corners of the box inlet was felt to be similar to that caused by contraction. If this were true, C_2 should be negative. However, C_2 was found to be positive for the single evaluation made and of a magnitude that indicates it to be significant. A zero correction was added to Equation (3) so that it reads

$$Q = C_1 g^{1/2} L H^{3/2} + C_2 g^{1/2} H^{5/2} + Q_0 \text{ --- (4)}$$

C_1 and C_2 are different in magnitude in Equation (4) than in Equation (3). Q_0 was negative for the single test evaluated. Its physical significance, like $H_Q = 0$, is not immediately apparent. The use of these zero corrections makes the extrapolations of these rating equations to prototype conditions questionable. However, their use greatly improves the accuracy of the model rating equations.

"The standard error of estimate, corrected for sample size, and its probable range computed with the aid of Fisher's z-transformation for a single group of nine runs covering a range of discharge from 0.119 to 0.503 c.f.s ($Q/N = 0.3008 \pm 0.0855$) for each of the above equations is:

<u>Equation</u>	<u>Lower Limit</u>	<u>Standard Error</u>	<u>Upper Limit</u>
(1)	0.0024	0.0031	0.0041
(2)	.0014	.0019	.0025
(3)	.0018	.0024	.0031
(4)	.0012	.0016	.0022

These figures indicate that Equation (4) gives the best results. The standard error of estimate for Equation (4) is 52 percent that of Equation (1), 62 percent that of Equation (3), and 84 percent that of Equation (2). The improvement in the accuracy of estimate through the use of Equation (4) is apparently significant.

"The results presented here are based on only one test and the computations have not been checked. They are indicative only, the analysis having been made in an effort to determine the best form of rating equation. A similar analysis will be made for several additional tests."

Drainage Studies - M. H. Gallatin, Homestead, Fla. - "Rainfall for this period was quite variable, 17.41 inches were recorded at the corner of Mowry and Redland Road, 7.16 inches at the west Mowry gage and 7.29 inches at the Highlands gage. The greater portion of the rain fell up to July 21. Nine rains of over 1 inch were recorded at the corner of Mowry and Redland road and seven rains of over 1 inch occurred at other stations. They were more frequent at these stations.

"The nitrate studies were carried on during this period. For the first part of the period up to July 21 some leaching of nitrates was apparent from the results collected. Our studies this month indicate that when heavy cover crops are cut you can expect an increase in available nitrates. This was brought out in, (1) a lime grove that had an especially heavy cover of weeds and grass, and (2) one of the avacado groves we are working on. The cover on the lime grove was cut

about June 30 with the nitrates at 28 p. p. m. On July 14 nitrates on this block had increased to 150 p. p. m. without the addition of fertilizers. The nitrates on the avacado grove jumped from 28 to 173 p. p. m. On the mature groves we are carrying in this study, this did not occur. At the present time on these areas nitrates have dropped back to where they were several weeks ago. Whether the dry weather has stopped nitrification and breakdown of this grass is not known or we are losing it as NH_3 . This will have to be checked.

"Up to July 21 there was little or no difference in the moisture readings for the various mulched plots, but from that time to the end of the month the intensity and duration of our rains has decreased and the readings taken on August 1 show that the check and natural growth plots are drying out very rapidly while the shavings, pine-straw and grass are about the same.

"During the period to July 21 all of our moisture blocks remained at or near saturation. Since that time to August 1 the blocks especially in citrus and limes show that they are drying out rapidly. In our older avacado groves where there is a good supply of organic matter or mulch material the losses were not as great. The cause for this wilting in the limes and citrus, I believe, can be explained as follows, during this period of excessive rain and as a result an almost saturated surface the trees put out new feeder roots near the surface so are quickly affected by lack of rainfall and a rapidly dropping water table."

Supplemental Irrigation Studies - James Turnbull, Lake Alfred, Fla.-

"Interception studies were concluded and the data analyzed. The interception by grape fruit trees averaged 22.7 percent of the rainfall with the amount of rainfall intercepted by individual trees varying from 13.1 percent to 39.6 percent. The interception by orange trees averaged 17.8 percent of the rainfall with the amount of rainfall intercepted by individual trees varying from 11.0 percent to 27.6 percent. As was to be expected, it was found that interception from small rains was a large percentage of the rainfall while that from heavier rains was a smaller percentage. Interception from small rains of a few hundredths of an inch was as high as 80 percent.

"Graphical analysis reveals that from rains of 0.20 inch, an average interception ranging from 30 percent to 35 percent can be expected; from rains of 0.50 inch, an average interception from 20 percent to 25 percent can be expected and from rains of 0.80 inch and over, an interception of 12 percent to 20 percent can be expected.

"Water-table studies show ground-water levels dropping almost a foot during the month with the lake rising constantly during the same period."

Supplemental Irrigation Studies - John R. Carreker, Athens, Ga.-"Supplemental irrigation was definitely needed the latter half of July in the vicinity of Athens. The rainfall pattern for the last days of June and all of July was:

June 21-22	1.95 inches
" 26	.22 "
" 27	.32 "
July 3	.03 "
" 6	.26 "
" 9	.15 "
" 17	.20 "
" 28	.10 "

July Total 0.74 inches

Normal rainfall in July - 5.04 inches

"Supplemental irrigation was applied to the pasture, corn, and vegetables as follows:

<u>Date</u>	<u>Pasture</u>	<u>Corn</u>	<u>Vegetables</u>
<u>Inches of Water Applied</u>			
July 3			0.8
" 14			1.0
" 15-16	2.0		
July 16-17		2.0	
" 22			1.0
" 28			1.0
" 29-30	2.0		
July 31 - Aug. 1		2.0	

"The unirrigated pasture was in such poor condition that the number of heifers was reduced from four to two on the 2 acres July 28. Eight heifers continued grazing the irrigated pasture throughout the month. The contrast of green growing grass on one and the burned dying grass on the other was quite impressive.

"The irrigated corn remained in excellent condition throughout the month and gave indications of high yield from all fertilizer treatments and hill spacings. The unirrigated corn showed definite signs of moisture deficiency. The stalks in the rows with 12-inch hill spacings and low nitrate application were fired to the ear. Higher nitrate fertilization coupled with 18- to 24-inch hill spacings showed less firing, however.

"The unirrigated beans, okra, and tomatoes were wilting during the hot part of the day and showing other signs of the need for moisture toward the last of the month. Those irrigated remained in excellent condition and showed much more vigor. Harvesting these crops was in full swing at the end of the month. The quantity and quality of the yields harvested to date were:

<u>Irrigated</u>			<u>Unirrigated</u>		
<u>Excellent</u>	<u>Good</u>	<u>Poor.</u>	<u>Excellent</u>	<u>Good</u>	<u>Poor</u>
<u>Pounds</u>			<u>Pounds</u>		
Pole beans:					
146.2			68.7	35.2	
Tomatoes:					
122.8	27.5	40.3	76.2	51.8	16.8
Okra:					
41.2		24.1	33.6		19.0

"The poor quality of tomatoes was caused by small size, deformity and diseases. The poor quality of okra was caused by the pods being too large to use. Although the okra was harvested every other day, a considerable number of pods became too large to use.

"Soil moisture readings taken July 29 with plaster of Paris blocks and a Boyou-cous bridge illustrated how dry the unirrigated soil was. Some comparative readings were:

Irrigated

Pasture II - 6" depth: 50,000 ohms.	Pasture IV - 6" depth: 250,000 ohms
Okra - 6" depth: 46,500 ohms	Okra - 6" depth: 465,000 ohms
Corn - 5-6" depth: 1,100 ohms	Corn 3 - 6" depth: 325,000 ohms

"The irrigated pasture and okra readings indicate the need for irrigation on these plots. All the unirrigated plot readings indicate the moisture is below the wilting point."

Sedimentation Studies - L. C. Gottschalk, Washington, D. C.-"During the month considerable time was spent on preparation of reports for publication. An inventory of published and unpublished sediment-load data in the United States was completed. This inventory, compiled under the supervision of the Sedimentation Section in cooperation with agencies represented on the Federal Interagency River Basin Committee's Subcommittee on Sedimentation, contains a listing of 1,276 separate stations where suspended-load measurements have been made. Besides the name of the station and the stream, the inventory contains information relative to the size of drainage area above station, the period of record, number of observations, type of sampling equipment, method of sampling, units of expression of load, and references to source of information

"Carl B. Brown completed a report entitled 'Reservoir Sedimentation in the Sacramento-San Joaquin Drainage Basins, California,' which gives results of investigations made in 1945-1946 in the Central Valley of California at the request of the Corps of Engineers, U. S. Army.

"Carl Brown revised his papers, 'Perspective on Sedimentation' and 'How Effective are Soil Conservation Measures in Sedimentation Control?' and I revised my paper, 'Analysis and Use of Reservoir Sedimentation Data,' which were given at the Denver Sedimentation Conference in May 1947 in form for publication in the 'Proceedings' of this conference.

"A bulletin entitled 'The Causes and Effects of Sedimentation in Lake Decatur' by Carl B. Brown, J. B. Stall, and E. E. DeTurk, Illinois Department of Registration and Education, State Water Survey Division Bulletin 37, 62 pp., 1947, was issued during July.

"I spent about a week analyzing data from an experiment on compaction carried out in Greenville, S. C., in 1939-1940. At present the mean density of sediment in a reservoir is determined from analysis of samples taken from the upper 2 or 3 feet, the limit of sampling with existing equipment. The experiment at Greenville, S. C., was carried out to determine the relationship of density of sediment to depth where depths exceed sampling limits. To determine this a measured quantity of sediment, about 2,700 grams, was allowed to settle in a 22-1/2-foot, transparent, calibrated, water-filled Lucite tube 6 inches in diameter. Each second or third day an equal portion was added until the depth of sediment amounted to nearly 14 feet. Each portion formed a separate layer such as might be expected in a reservoir. Knowing the weight of each layer and measuring the volume in the calibrated tube, the approximate density of each layer could be determined. The results of the analysis indicate that the relationship between density and depth may be expressed by the empirical formula:

$$C = 22.85 \div 1.06d \div 0.00129e^{0.695d}$$

where C = Density of sediment, in pounds per cubic foot
d = Depth of sediment, in feet
e = Base of natural logarithms

Drainage Studies - I. L. Saveson, Baton Rouge, La.--"The compiling of the data for the Westover Plantation test area was completed this month. The Westover test area consists of 18 cuts of approximately 78 acres (plantation crop acres), the area being 6 cuts wide and 3 cuts long. The cuts were crowned (often called turtlebacking), to ascertain costs on a production basis. Previous crowning work was done on a 1 cut basis. The cuts on the Westover area vary in width from 170 feet to 300 feet. This gives us a comparison of equipment operation on various widths of cuts and also an indication on the possible maximum width of cuts in conjunction with cut crowning. The lateral ditches on this test area were cleaned ahead of the crowning work with the plantation straddle dragline and sloping side bucket. Mr. Saveson submitted cost data for this area. Copies will be gladly furnished upon request.

"The area was worked in blocks of 3, 2, and 1 cuts long in order to give the greater efficiency by minimizing the amount of turning. This is very evident in the Parsons Whirlwind operation. Operating 2 cuts long over 1 cut long reduced the costs from \$12.61 per acre to \$9.91 per acre. The road cuts listed is a condition found on most plantations where a canal is located along side of the cut and a road has been built on the spoil, thus impounding the water in the cut. This requires considerable earth moving to facilitate the drainage. The plantation crop acreage was used. The acreage covered is larger but this is the basis on which sugar planters judge the amount of work.

"There has been considerable interest in this work. During the 6 weeks construction period from 2 to 10 people visited the project approximately 3 days each week, consisting of Louisiana sugar planters, machinery people, and sugar people from the Carribean area, Trinidad, and South America. The Soil Conservation District Supervisor, personnel, and interested planters from Thibodaux visited the project on the 28th of May, totaling 38 people.

"The County Agent of West Baton Rouge parish held a field day at the project on July 5. Better than 200 people attended this meeting."

IRRIGATION DIVISION

W. C. Barrett reports completion of snowmobile #2. This machine, designed with a floating track suspended from near the middle, introduces a departure from the design of machine #1, which was tried out in field trials during the spring snow-survey season. Number 2 machine is powered by a Crosley engine and weighs approximately 1,200 pounds. It will be given intensive field trials next winter. Work was resumed on model #1 to overcome the weaknesses found during the 1947 field trials.

D. K. Fuhrman reports, "Statistical analysis of all Utah snow courses for the 5-year period 1940-44 inclusive shows that 83 percent of the course measurements each year have a standard error of less than 5 percent of the water content measured. This indicates that the majority of Utah snow courses are so located that variation in water content along the snow course at any one time is very low and that the individual samples are comparable to the average of the course. When this situation exists, the significance of water-content increase is much more accurately obtained. Data analyzed are to be used in a progress report of the Utah snow-surveying program now in preparation."

C. W. Lauritzen reports, "Routine observations on the experimental linings in Channels A and B were continued. The gravel in Channel C has been screened and the large sizes removed in preparation for installation for another series of linings. The subgrade of these linings will be a mixture of quarter inch gravel and sand, rather than the graded gravel which constitutes the subgrade in Channels A and B.

"Preliminary drawings and cost estimates for the addition of six experimental channels having a range of grades designed to give velocities of 1, 2, 3, 6, 9, and 12 feet per second have been prepared.

"A tentative agreement was reached with Mr. E. L. Silver, American Gunitite Company, whereby he would install 100 feet sections of the following linings:

1. 1" gunitite
2. 1" gunitite plus 4 x 4 - 12/12 reinforcing mesh
3. 2" gunitite
4. 2" gunitite plus 4 x 4 - 12/12 reinforcing mesh

"These linings will be duplicated at two sites in order to secure different subgrade conditions. An attempt will be made to obtain ditches for lining with a wetted perimeter of about 10 feet. Carrying out of this plan is dependent on locating canals in which the company will be willing to foot the bill for shaping, trimming, and part of the materials. It is not anticipated that any of this work will begin until the end of September."

Karl Harris reports that his infiltration studies on three fields that had gypsum applications for 1-1/2 years showed no benefits to infiltration rates. Studies were continued on effect of irrigation on soil temperature.

Clyde Houston reports progress in reviewing, classifying and bringing up to date all snow-course records in Nevada. In order to correlate all the forecasting and snow surveys in Nevada, Houston prepared a cooperative agreement between the Nevada Agricultural Experiment Station, the Nevada State Engineer, and the Soil Conservation Service relative to the water-supply forecasting and irrigation investigations in the State of Nevada. This agreement has been forwarded to Washington for consideration.

9/2/47